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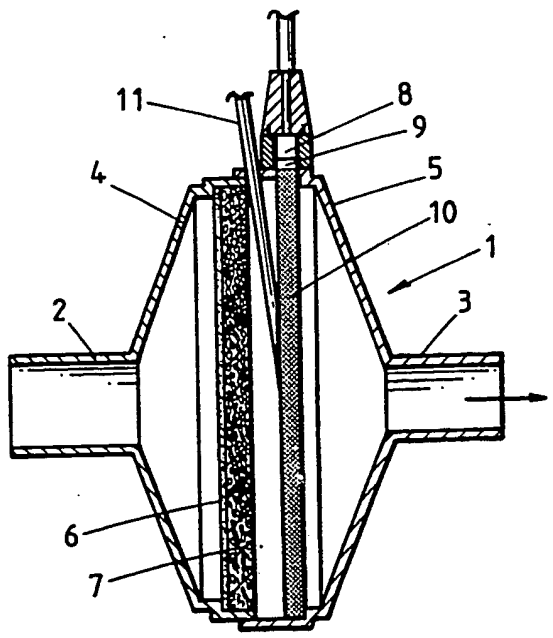
(54) Title: A DEVICE FOR COMPENSATING FOR THE MOISTURE AND HEAT LOSSES FROM AN ARTIFICIAL NOSE



(57) Abstract

A device for compensating for the moisture and heat losses occurring in artificial noses to be incorporated in the duct for supplying air and/or gasses to a patient and which is composed of a chamber (1) used as actual artificial nose wherein a hygroscopic material (7) serving as a buffer is provided, with means to maintain the in- an exhaled between the artificial nose and the

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"A device for compensating for the moisture and heat losses from an artificial nose".

This invention relates to a device for compensating for the moisture and heat losses from an artificial nose used with a patient.

Artificial noses are devices which are incorporated in a duct between a patient and a machine, usually known as a ventilator, in order to allow the patient to recuperate a portion of the moisture and heat comprised in his exhaled air. Artificial noses are mainly used for anesthesia and/or for artificial respiration, such artificial noses including a buffer, i.e. the moisture exchanger element, generally called HME.

In many cases, such a device is not sufficient for maintaining the humidity and the temperature on the desired level.

Indeed, different types of artificial noses have the very serious drawback of involving, in the most advantageous circumstances, a moisture and heat loss of about 30 %.

Therefore, an object of the invention is to prescribe a device which solves the hereabove mentioned problem in a reliable way and which assures therefore the required humidity and temperature level of the air and/or mixture of air and gasses supplied to the patient, whatever may be the shortcomings of the artificial nose which is also known in the technical jargon as "heat moisture exchanger or HME".

In order to realize this according to the invention, the device according to the invention is provided to be incorporated in the duct for supplying air and/or gasses to a patient and is composed of a chamber used as actual artificial nose wherein a hygroscopic material serving as a buffer is provided, with means being provided to maintain the air in- and exhaled by the patient, at the required heat level, between the artificial nose and the patient.

In the most advantageous embodiment, said means is a heating resistance which is positioned at a distance from said hygroscopic material.

According to a possible embodiment, said resistance is mounted in said chamber.

According to a possible variant, said resistance is mounted outside said chamber, between this chamber and the patient.

It is advisable that said resistance is externally water-absorbent and means are provided for supplying water to this resistance.

According to a possible embodiment, said resistance is enclosed by a sleeve composed of a water-absorbent textile to which water is supplied.

According to another possible embodiment, said resistance is composed of a textile, at least a part of the weft and/or warp threads of which consist of heating resistances.

Other details and advantages of the invention will become apparent from the following description of a device for compensating for the moisture and heat losses from an artificial nose used with a patient according to the invention. This description is only given by way of example and does not limit the invention. The reference numerals relate to the annexed figures.

Figure 1 is a longitudinal sectional view through the device according to the invention.

Figure 2 is, on a larger scale, a side elevation view of a heating resistance according to a first possible embodiment.

Figure 3 is a longitudinal sectional view through a variant of the invention with disassembled components.

Figure 4 is a front elevation view of a cross-section according to line IV-IV in Figure 3 of a resistance according to a variant.

Figures 5, 6 and 7 show schematically three possible arrangements of a pump and a container with water in a device according to the invention.

The device according to figure 1 consists of a chamber 1 with two mouthpieces 2 and 3 which are connected to a not represented duct to a machine (a ventilator is usually meant here).

The function of an artificial nose (in the technical jargon usually called HME) has been described in broad outline in the introductory portion.

The device by which the heat and moisture losses from an artificial nose can be compensated for, consists therefore of a chambre 1 which can be realized for example by coupling two halves 4 and 5 to which the already mentioned mouthpieces 2 and 3 are connected. Since in normal conditions, i.e. when the air circulates from the left to the right (according to Figures 1 and 3) or vice-versa, the mouthpieces 2 and 3 can be considered alternatively as an inlet and outlet for the air circulating through said chamber. Referring to Figures 3 and 5-7, the patient is located in the direction indicated by a small arrow.

In the supposition that the artificial nose is located in the device at the side of mouthpiece 2, the following succession of components can be seen successively in chamber 1 :

a) a bacterial filter 6

b) a hygroscopic material 7 causing a buffer effect. The shape of the hygroscopic material 7 is adapted to the cross-section of chamber 1. In this case the shape of a disk. Each material with important hygroscopic properties can be used herefor. Use can be made of a spongy material or of corrugated paper to which a hygroscopic substance has been added ;

c) a resistance 8, which projects into a metal sleeve 9, is provided at a clear distance from the disk of hygroscopic material 7. Such a sleeve can best be made of aluminium. Although this is not essentially required, it is advisable that a water-absorbent material 10 is applied substantially over the whole length of sleeve 9. A textile can be used hereto but the metal sleeve 9 may be covered with a water-absorbent material. Water is then supplied to the water-absorbent material 10 either directly by gravitation or by means of a pump and this through a duct 11.

The hereabove under c) mentioned resistance 8 is a self-regulating resistance with a 12V source.

In a variant, the self-regulating resistance may be present in the shape of a disk 12 (Figures 3 and 4). Such a disk is cut out of a textile, some of the warp and/or weft threads of which are electrically conductive. The current can be supplied in the way shown in Figure 4, where two conductors 13 and 14 are provided in an arc-shape over a part of the disk. In the supposition that the resistance threads are arranged vertically (according to Figure 4), there will be tension mainly on a vertical middle-strip. If necessary, water can be supplied through a duct 11 to this disk 12 or to the middle-strip of the latter.

The structure of the electrically conductive threads as well as of the other threads allows a regular distribution and therefore also a regular evaporation of the water.

The disk 12 can be clamped between the two halves 4 and 5 composing the chamber 1 or can be fixed to the wall of halve 5 by any appropriate technique known per se.

By a standard choice of the resistances, as well of these which have the shape as shown by figures 1 and 2, as of those which have the shape of disk 12, and by dosing the amount of water reaching these resistance through duct 11 according to the needs, the temperature as well as the humidity of the air inhaled by the patient through the artificial nose can be maintained at the desired level by evaporation.

Supplying water is not essentially required. The hygroscopic material provides for a buffer effect which optimizes the humidity of the circulating air. By heating the air, a larger amount of moisture will condense and will be absorbed by the hygroscopic material so that the moisture loss will be reduced to an acceptable minimum.

Therefore, heat and moisture losses in the artificial nose can be compensated for by technically reliable means which are easy to control.

The buffer effect caused by the hygroscopic material 7, is considerably increased by the presence of a self-regulating resistance according to one of the two hereabove described embodiments at a distance from this material. These resistances are either PTC-or NTC-resistances.

Still according to the spirit of the invention, the here described resistances of the type according to Figure 2 or according to Figure 4, can be mounted completely outside chamber 1. In this case, chamber 1 with the hygroscopic material 7 and the bacterial filter 6 is reduced to the actual artificial nose. The resistance covered by the textile which is in contact with this resistance through the aluminium sleeve 9, or the resistance from the textile which forms the disk 12 and to which water is supplied, is then incorporated in the duct, which has already been put forward hereinabove, between the artificial nose and the patient. When the buffer effect of the hygroscopic material 7 fails or falls out, the effects of the resistance of the type according to Figures 1 and 2 or of the type according to Figure 4 will compensate for the moisture and heat losses in a satisfactory way.

In the device according to the invention, the moisture supply through duct 13 can be dosed by means of a pump 14 which receives the moisture from a container 15. A transformer 16 supplies a low-voltage current to resistance 8, 12, to pump 14 as well as to a programmable unit 17. The programmable unit 7 receives signals from a quick reacting temperature sensor 22 (Fig. 5-7) which detects the flow and the flow times of the air supplied to a patient. The pump 14 may run also continuously at an adjustable flow rate which is situated in practice between 2 and 10 ml/hour. Pump 14 may be omitted if the moisture supply is realized by gravitation as shown by figure 6. In such a variant embodiment, a squeeze-valve 18 is mounted in the water supply duct 13'. The water is delivered from a receiver 19. In this case, programmable unit 17 responds to the squeeze-valve 18.

Finally, moisture (usually water is meant hereby) can be supplied by capillarity to a resistance (for example 8). A possible embodiment based on this principle is shown in Figure 7, wherein a wick 20 supplies the moisture from a container 21 to the resistance 8.

From the hereabove description of the device according to the invention, it is therefore apparent that an excellent solution is provided, by technically simple but reliable means, for the problem consisting in assuring the heat and moisture level in or in combination with an artificial nose.

CLAIMS

1. A device for compensating for the moisture and heat losses from an artificial nose used with a patient, characterized in that it is provided to be incorporated in the duct for supplying air and/or gasses to a patient and that it is composed of a chamber (1) used as actual artificial nose wherein a hygroscopic material (7) serving as a buffer is provided, with means being provided to maintain the air in- and exhaled by the patient, at the required heat level, between the artificial nose and the patient.

2. A device according to claim 1, characterized in that said means is a heating resistance which is located at a distance from said hygroscopic material.

3. A device according to claim 1, characterized in that said means is a heating resistance which is in contact with said hygroscopic material.

4. A device according to anyone of the claims 1 to 3, characterized in that said heating resistance (8, 12) is mounted in said chamber.

5. A device according to anyone of the claims 1 to 3, characterized in that said heating resistance (8, 12) is mounted outside said chamber (1), between this chamber (1) and the patient.

6. A device according to anyone of the claims 1 to 5, characterized in that said heating resistance (8, 12) is a self-regulating heating resistance.

7. A device according to anyone of the claims 1 to 6, characterized in that said heating resistance (8) is externally water-absorbent and in that means are provided for supplying water to this resistance.

8. A device according to anyone of the claims 1 to 7, characterized in that said heating resistance (8) is enclosed by a metal sleeve (9) which is water-absorbent at its outer surface.

9. A device according to claim 8, characterized in that a water-absorbent textile is applied around the metal sleeve (9).

10. A device according to claim 8, characterized in that a water-absorbent material is applied to said metal sleeve (9).

11. A device according to anyone of the claims 1 to 10, characterized in that said resistance is a PTC-resistance.

12. A device according to anyone of the claims 1 to 10, characterized in that said resistance is a NTC-resistance.

13. A device according to anyone of the claims 1 to 6 and 11 or 12, characterized in that said resistance comprises a disk (12) of textile, at least a portion of the warp and/or weft threads of which are electrically conductive.

14. A device according to anyone of the claims 1 to 5 and 7 to 13, characterized in that said heating resistance is provided with a thermostat.

15. A device according to anyone of the claims 7 to 14, characterized in that the means for supplying water to said heating resistance are controlled by a pump (14) which receives signals from a quick reacting temperature sensor (22) which detects the flow and the flow time of the air supplied to a patient by means of a ventilator.

16. A device according to claim 15, characterized in that said flow time is detected by means of a temperature sensor (22) and means are provided for sending this information to a programmable unit (17) in order to control said pump (14).

17. A device according to either one of claims 15 and 16, characterized in that means are provided for stopping said pump (14) when no air flow is detected by said temperature sensor during a predetermined time unit.

18. A device according to anyone of the claims 6 to 17, characterized in that said water supply is realized from a water reservoir.

19. A device according to anyone of the claims 6 to 18, characterized in that a squeeze-valve (18) is provided when the water supply is realized by gravitation, which valve is controlled by means dependent on the air flow created in the artificial nose.

20. A device according to claim 19, characterized in that said means comprise a temperature sensor (22) which detects the flow and the flow time of the air supplied to a patient by means of a ventilator.

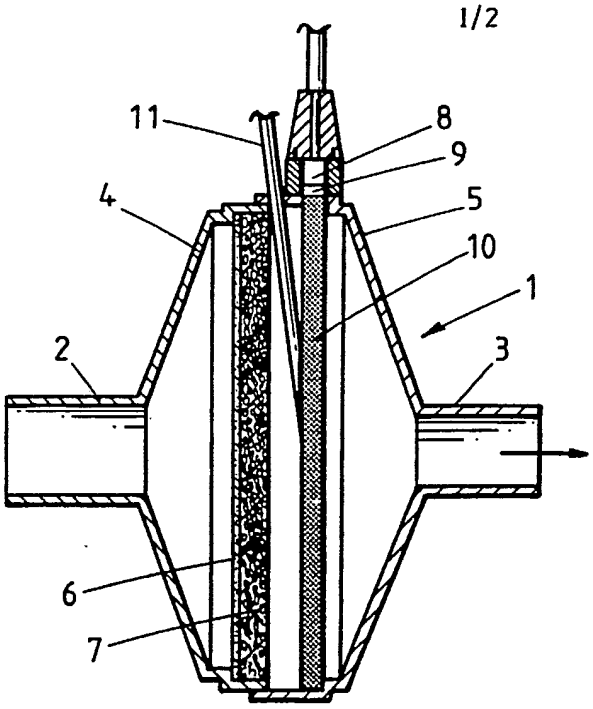

Fig.1

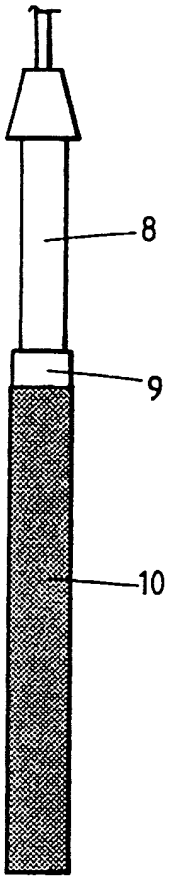

Fig.2

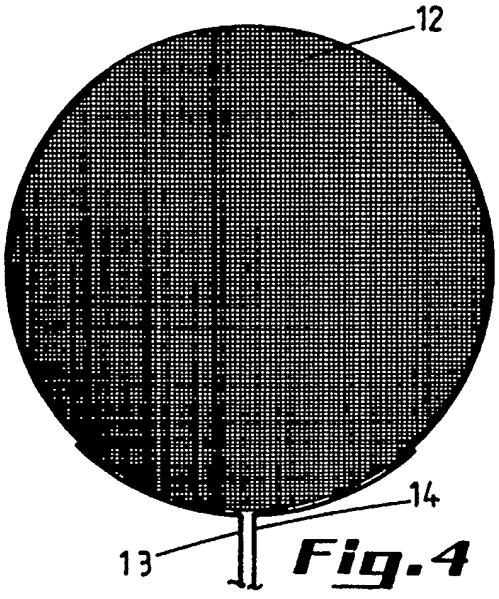

Fig.4

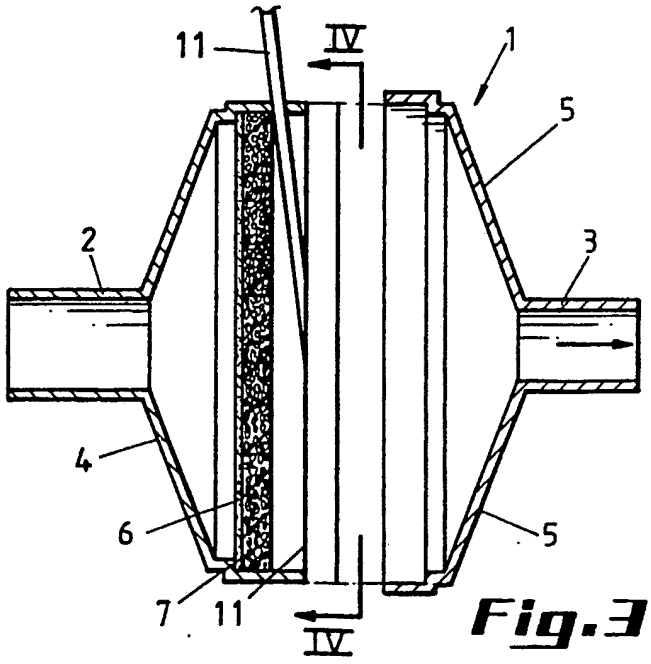

Fig.3

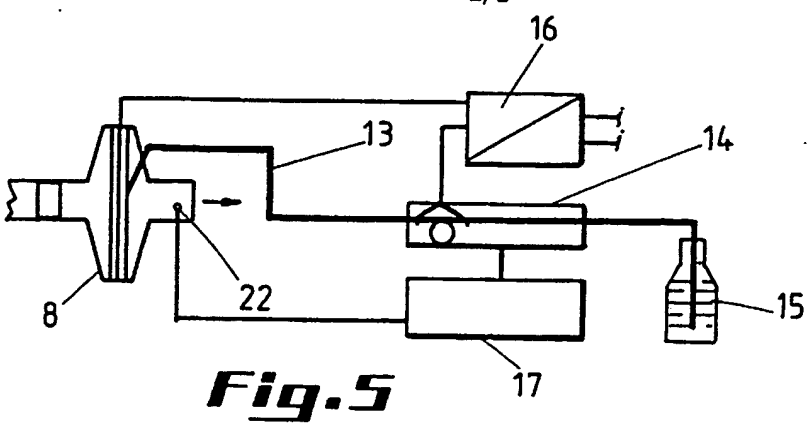

Fig.5

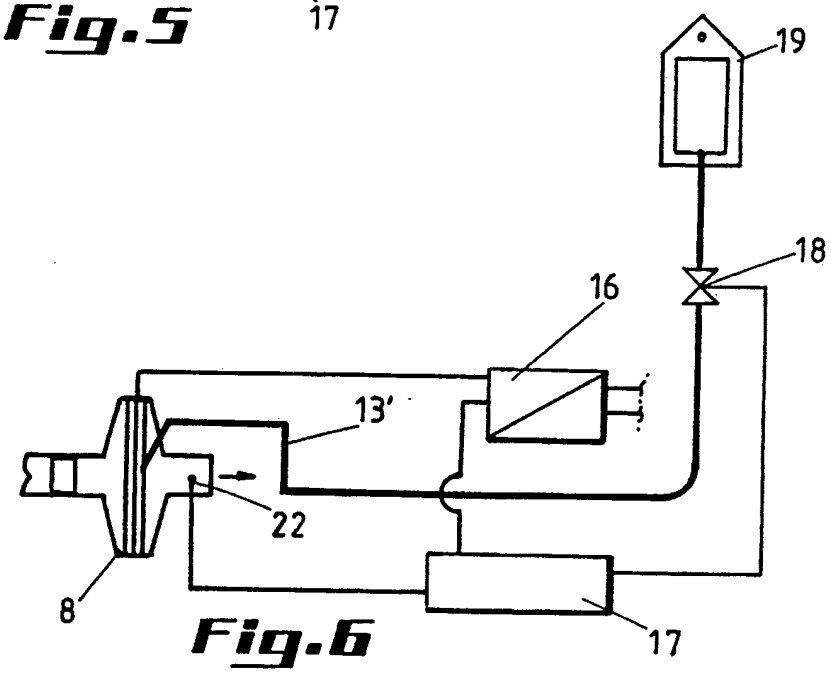

Fig.6

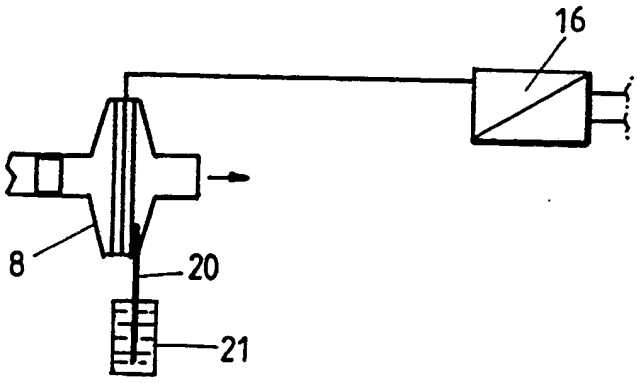

Fig.7

INTERNATIONAL SEARCH REPORT

International Application No PCT/BE 91/00038

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 A61M16/10 ; A61M16/00

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	A61M

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category °	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
Y	FR,A,2 304 359 (TERUMO) October 15, 1976 see page 3, line 9 - line 20 see page 4, line 34 - page 5, line 13; figures 1,2,3	1-8, 10-12,18
Y	EP,A,201 985 (B.O.C.) November 20, 1986 see abstract; figure 2	1-8, 10-12,18
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Y	EP,A,258 928 (PONNET ET AL) March 9, 1988 see the whole document in partic. Col 1,line 45- col.2,line4,fig. 1	6,18

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
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III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

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Y	DE,A,3 311 811 (HIRTZ) October 4, 1984 see page 7, line 5 - line 9; figure 1	11
Y	DE,A,3 818 070 (BOGDANSKI) December 7, 1989 see page 5, line 5 - line 9; figures 1,3	12
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ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.

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